CEL-MAR®
Zakład Informatyki i Elektroniki

User manual

ADA-1040A

Addressable RS-232 to RS-485/RS-422 Converter



Contents

1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.
If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail support@cel-mar.pl.

1.1. WARRANTED INFORMATION

The **ADA-1040A** converter is covered by a two year warranty from date of sale. In case of being damaged it will be repair or the damaged component will be replace. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions, will be repaired or replaced.
All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company.**
CEL-MAR Company under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.
CEL-MAR Company is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.
In specific cases CEL-MAR Company discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.
Do not put device on the wet surface.
Do not connect devices for nondescript powering sources,
Do not damage or crush powering wires.
Do not make connection with wet hands.
Do not adapt, open or make holes in casings of the device!
Do not immerse device in water or no other liquid.
Do not put the fire opened on device sources: candles, an oil lamps and the like.
Complete disable from the supply network is only after disconnecting the power supply circuit voltage.
Do not carry out the assembly or dis-assembly of the device if it is enabled. This may result to short circuit and damage the device.

1.3. CE LABEL

CE symbol on organizing the company CEL-MAR a conformity of the device to the directive of the electromagnetic EMC 2004/108/WE compatibility means (Electromagnetic Compatibility Directive). The declaration of the agreement is accessible through the contact with the technical service at the address e-mail: serwis@cel-mar.pl or on the phone at the +48 41 362-12-46.

1.4. ENVIRONMENTAL PRESERVATION

This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

1.5. SERVICE AND MAINTENANCE

The ADA-1040A converter does not require the servicing and maintenance.
Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday.

2. PRODUCT INFORMATION

The converter is delivered with the user manual, resistors: Rt=120Ω (2 pcs.), CD-ROM with ADAConfig software.

2.1. PROPERTIES

- Possibilities of adding the address to no-addressable device, connected to RS232 port,
- The conversion of parameters and baud rate on RS485/422 and RS232 ports of the converter,
- Operating on 2-wire or 4-wire RS485/RS422 bus in point-to-point and multipoint topology,
- Conversion of TX, RX signals,
- Operating up to 32 devices on RS485 bus,
- Baud rate (bps) set on RS232 and RS485/422 interfaces: 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
- Data format set on RS232 and RS485/422 interfaces::
  - number of data bites: 5, 6, 7, 8,
  - parity: None, Odd, Even,
  - number of stop bits : 1, 2,
- Transparent for all protocols which data format is in accordance with the above specifications e.g. MODBUS, DNP, PROFIBUS and other,
- Power supply 10 - 30 VDC stable, 2W,
- 5kV= optoizolation in signal channel between RS232 interface and RS485/422 interface,
- 1kV= or 3kV= galvanic isolation between RS232 interface and power supply,
- Short circuit protection and over-voltage protection on the lines RS485/422 interface,
- Short circuit protection ESD 15kV RS232 interface,
- Connection of RS485/422 bus and power supply via screw terminal block, cross section up to 2.5 mm^2,

- DB-9F connector for cable connection of RS232 interface to PC, controller, cash register,
- DIN 43880 standard - mounting in typical electro-installation unit,
- Rail mounting according to DIN35 / TS35 standard,
- Dimensions (W x D x H) 53mm x 58mm x 90mm.

2.2. DESCRIPTION

ADA-1040A Addressable converter enables adding the address to RS-232 interface not addressable device, this solves the problem of connecting these devices to multipoint RS-485 bus. At the same time the converter makes conversion of RS-232 standard to RS-485/RS-422 with the possibility of interference with the format of transmitted data. Depending on the configuration can be adjusted: baud rate, number of data bits, parity or no parity and number of stop bits – the setting can be different for RS-232 or RS-485/RS422 ports.
ADA-1040A uses signals Rx, Tx and GND, inducted by DB-9F socket. Converter does not require power supply from RS232 port, supports asynchronous data transitions rate up to 230,4 kbps.
Connector DB-9F is made like DCE, it let connect converter to other device using the extension cable RS232 (typical cable for modem connection) without crossing TX with RX.
Over-voltage protection on each RS485/422 lines, was made on the base over-voltage LED's and the fuses.

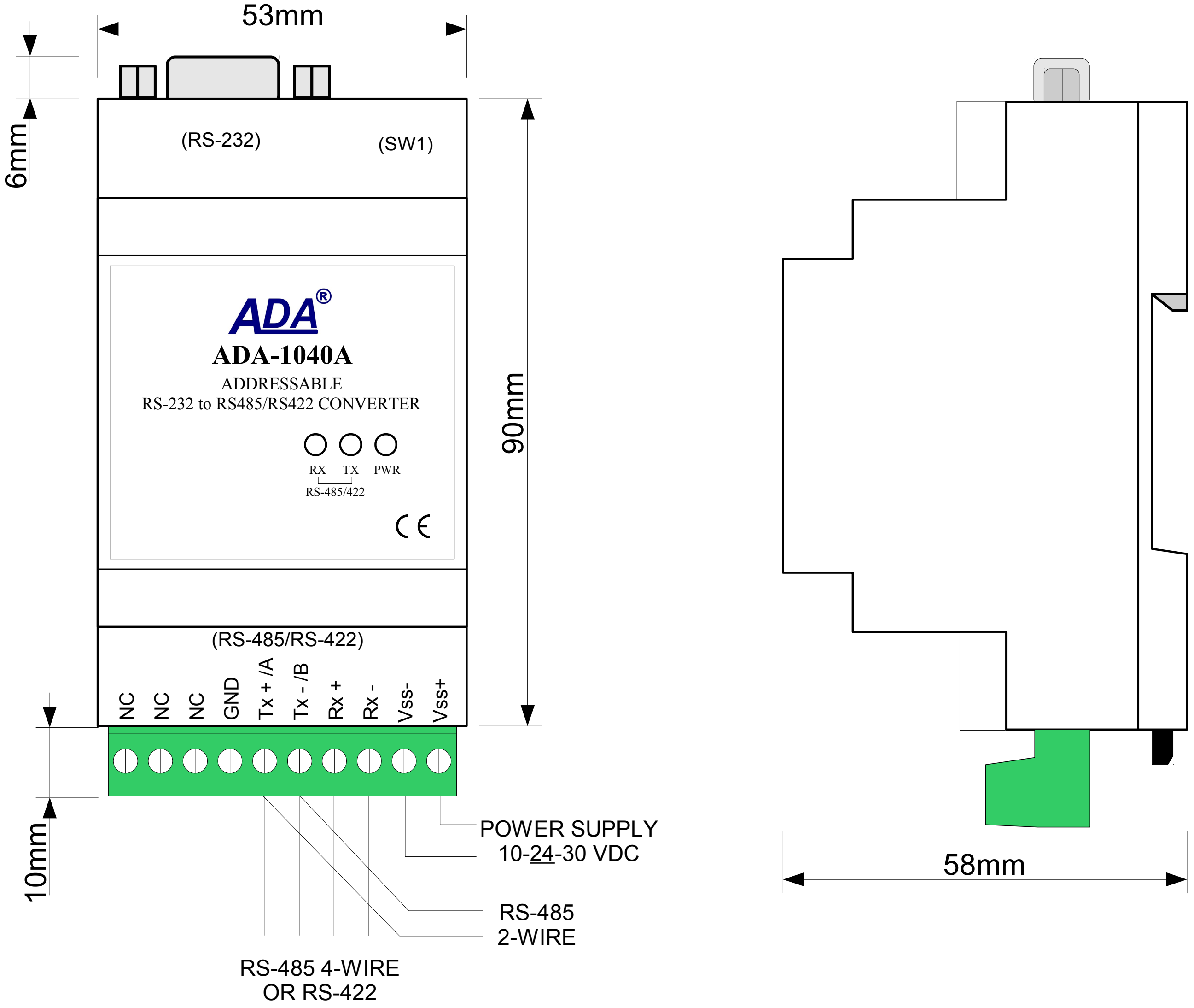


Fig. 1. View ADA-1040A and location SW1 switch

2.3. ISOLATION

Converter ADA-1040A has 2-way or 3-way and 1kV= or 3kV= galvanic isolation (depend on version, described in section VERSIONS).

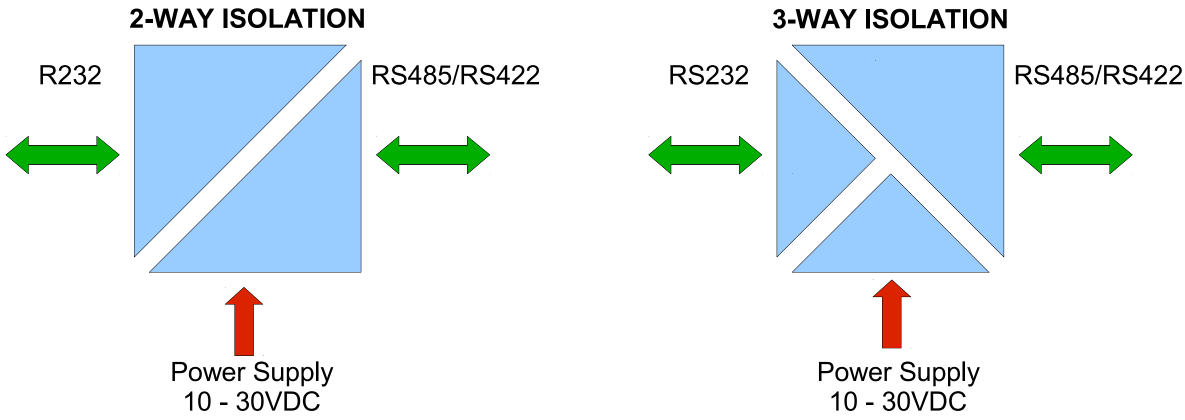


Fig. 2. Isolation diagram

3. INSTALLATION

This chapter will show how to connect ADA-1040A to PC, RS485 & RS422 bus, and power supply and how to use it.
To reduce disturbance from environment, it is recommended to:

- use multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- use the suitable diameter cable for power supply on account of voltage drop,
- use the powering cable with a suitable section because of the voltage drops,
- use the interference eliminators for powering the converter,
- lay signal cables at a distance of not less than 25 cm away from power cables,
- not powering the converters form the power-circuit of devices generate large impulse disturbance like contactors, relays, inverters

3.1. ASSEMBLING

ADA-1040A converter case is adapted to assembly on TS-35 (DIN35) rail. To install converter should mount device on the rail upper part of the case then press bottom part to hearing characteristic „Click” sound.

3.2. CONNECTION TO COMPUTER OR RS232 PORT DEVICE

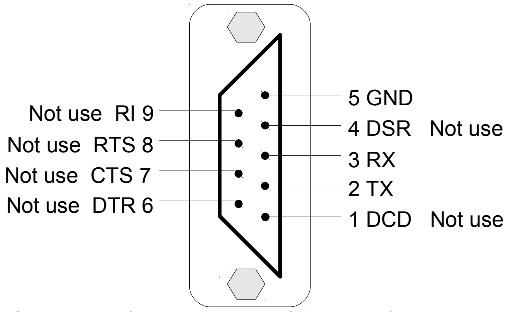


Fig. 3. RS232 interface signals of DB-9F (female) connector.

In case of connection ADA-1040A converter to:
- RS232 port of computer or device, should make a cable accordance to Fig.4
- USB port of computer, should have additional converter USB to RS232 (ADA-I9110 or ADA-I9111), which connect to RS232 port of ADA-1040A, like on the Fig.5.

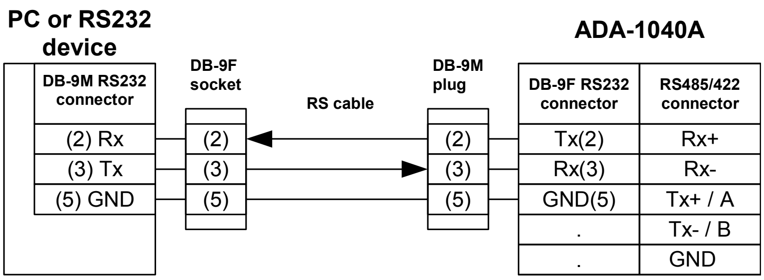


Fig.4. ADA-1040A connection to PC or device with RS232 by the use of cable

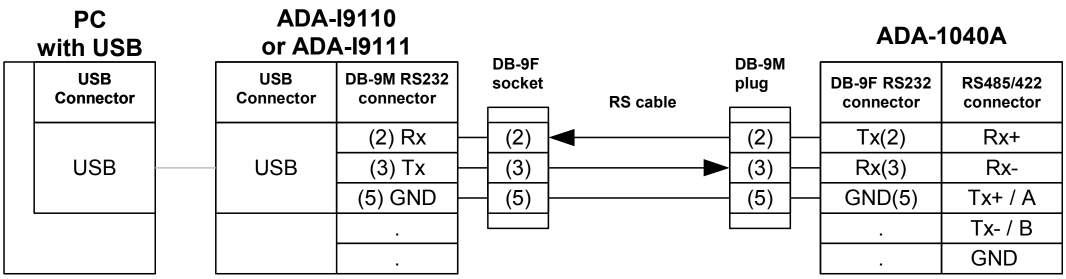


Fig. 5. ADA-1040A connection to PC by the use of USB to RS232 converter ADA-I9110/ADA-I9111

3.1. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-1040A converter is available on screw terminal block and is described as: Tx+/A, Tx-/B, Rx+, Rx-. Connection of ADA-1040A to RS485(4W) and RS485(2W) network are shown bellow.

3.1.1. CONNECTION TO RS485 (4-WIRE) BUS

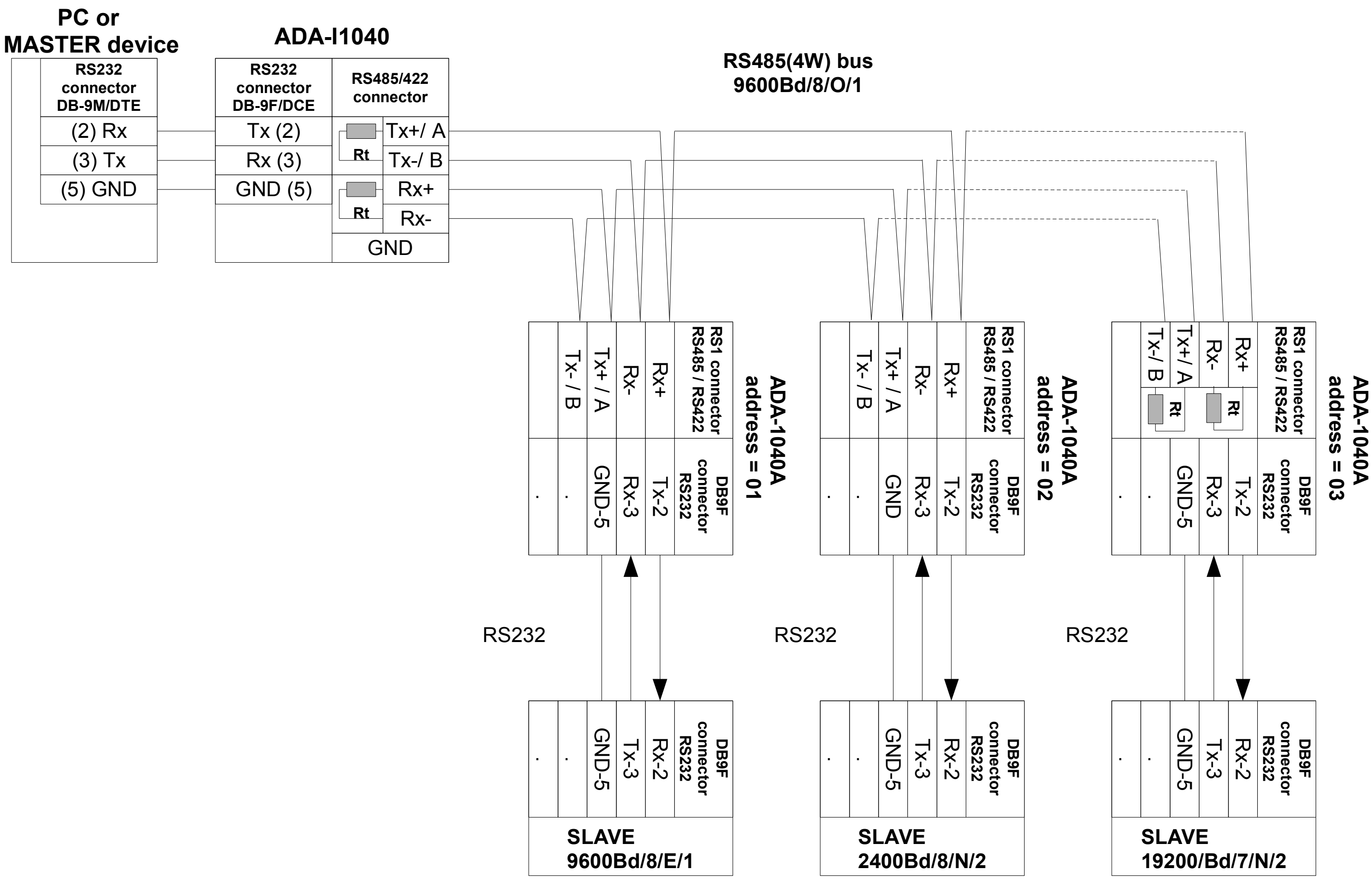


Fig. 6. Example connection of ADA-1040A to RS485(4W) 4-wire bus and galvanic separation of SLAVE device

3.1.2. CONNECTION TO RS485 (2-WIRE) BUS

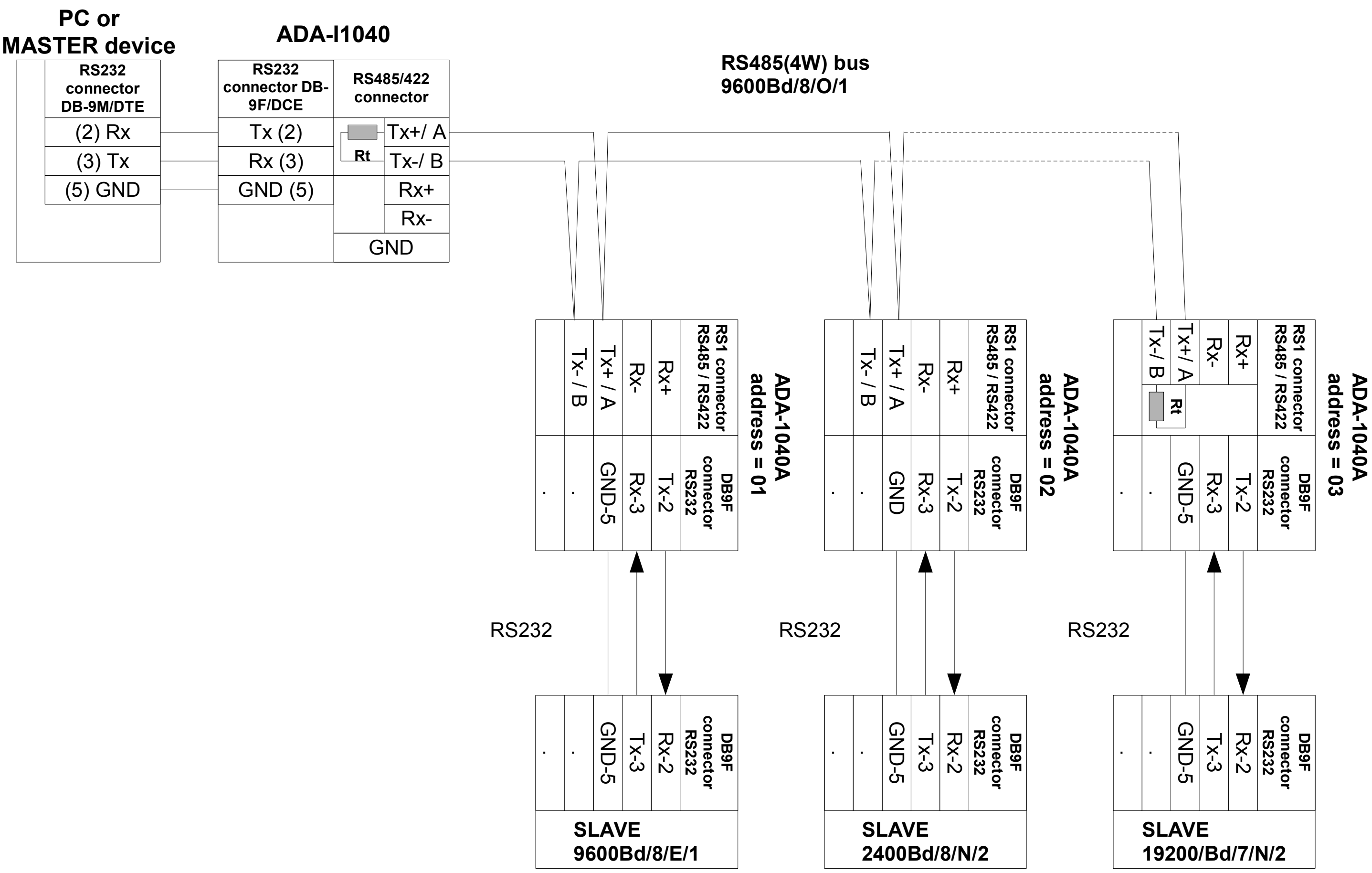


Fig. 7. Example connection of ADA-1040A to RS485(2W) 2-wire bus and galvanic separation of SLAVE device

3.1.3. LINE TERMINATION Rt

The application of Line Termination (terminator) Rt = 120 Ω (ohms) will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. Should be used the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd, and if the disturbance in transmission will appear.
Example connection of Rt are shown on Fig. 6 & 7. Two Rt=120 Ω , 5%, 0,25W are delivered with the converter.

3.1.4. CONNECTION OF RS232 INTERFACE DEVICES

Connection of SLAVE devices with RS232 interface to ADA-1040A, are shown on fig. 6 and fig. 7.

3.2. POWER SUPPLY CONNECTION

To connect power supply to the converter, should have DC power supplies (regulated) output voltage from 10 V= to 30V=, min. nominal power 2W, e.g. ZS-12/250. Power cable from DC power supplies to device can not be longer than 3m.
Should connect positive (+) end of DC power supplies to V+ converter's terminal and negative (-) end to V- on terminal block. ADA-1040A has protection against power supply reverse connection.

4. ACIVATION

The converter can be power on after properly connection according to section above.
If after connection power supply on front panel will not light green led PWR, check correctness of power supply connecting (polarization). When data is present the LEDs Tx and Rx should blink.

4.1. DESCRIPTION OF SIGNALLING LEDS

LED	***Description***
PWR	Signalling of Power Supply
RUN mode	
RX	Signalling of data receiving through ADA-1040A from RS485 port
TX	Signalling of data transmitting from ADA-1040A through RS485 port
Configuration mode	
LED by SW1	Blink with frequency 1 Hz - signalling of configuration mode (see micro-switch SW1 setting)
Firmware update mode	
LED by SW1	Blinking signalling software data flows to converter.

ATTENTION!
AT BAUD RATE ABOVE 38.4 KBPS THE LED'S TX, RX WILL LIGHT WEAKLY DURING DATA TRANSMISSION

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not light	Check polarization and parameters of connected power supply.
Rx LED lights continuously	RS485(4W) /422 network. Wrong polarization on terminals: Rx+, Rx-; change polarization.
	RS485(W) network. Wrong polarization on terminals: Tx+/A, Tx-/B; change polarization.
No transmission Tx LED is blinking	RS485(4W) / RS422 network. Check correctness of connection to terminals Tx, Rx; according to point 3.

5. CONFIGURATION

5.1. OPERATION MODE

The ADA-1040A converter can operates in a few modes :
- RUN mode,
- configuration mode,
- emergency firmware update mode,

Those modes can be set by use SW1 located by DB-9F connector, labelled as RS232. To set the switch section, should remove the cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver.
All available adjusting the SW1 switch are shown in table below.

Converter operation modes

SW1- 1	***SW1- 2***	***Mode***
OFF	OFF	Run
ON	OFF	Configuration
ON	ON	Emergency firmware update

5.2. CONFIGURATION BY USING ADACONFIG

The configuration of ADA-1040A converter can be made by the use of *ADAConfig* Software - selling with converter.
To make the configuration, connect converter to computer and power supply. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity). If the PWR LED lights, set the section of SW1 switch to configuration mode as in table below.

SW1-1	***SW1-2***
ON	OFF

In the configuration mode the yellow LED located by SW1 micro-switch will blink with frequency 1 Hz. Start the ADAConfig Software and make the configuration of transmission parameters for each converter interfaces. First, should be set the number of COM port for communication with the converter, then readout the configuration from ADA-1040A memory using the button ***[Read converter configuration]*** and make the proper changes of each interfaces setting. If the option Addressing Converter will be set, on configuration window should be set proper converter address from range 1 - 255. If this option is OFF the converter will function as baud rate converter.
In both cases, is possible to set additional transmission parameters for RS232 interface and RS485/422 as below:
– baud rate (kbps): 0.3, 0.6, 1.2, 1.8, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2, 230.4,
– number of data bites: 5, 6, 7, 8,
– control parity: no control, parity control, control of none parity,
– number of stop bits : 1, 2,
– frame spacing – range from 4 to 255 (time silence as frame's end),
– data flow control – not available yet.
After configuration, the setting should be saved on converter memory by using button ***[Write converter configuration].***
Return to work in run mode is made by using SW1 switch as below.

SW1-1	***SW1-2***
OFF	OFF

The yellow LED (located near the SW1), will turn off.

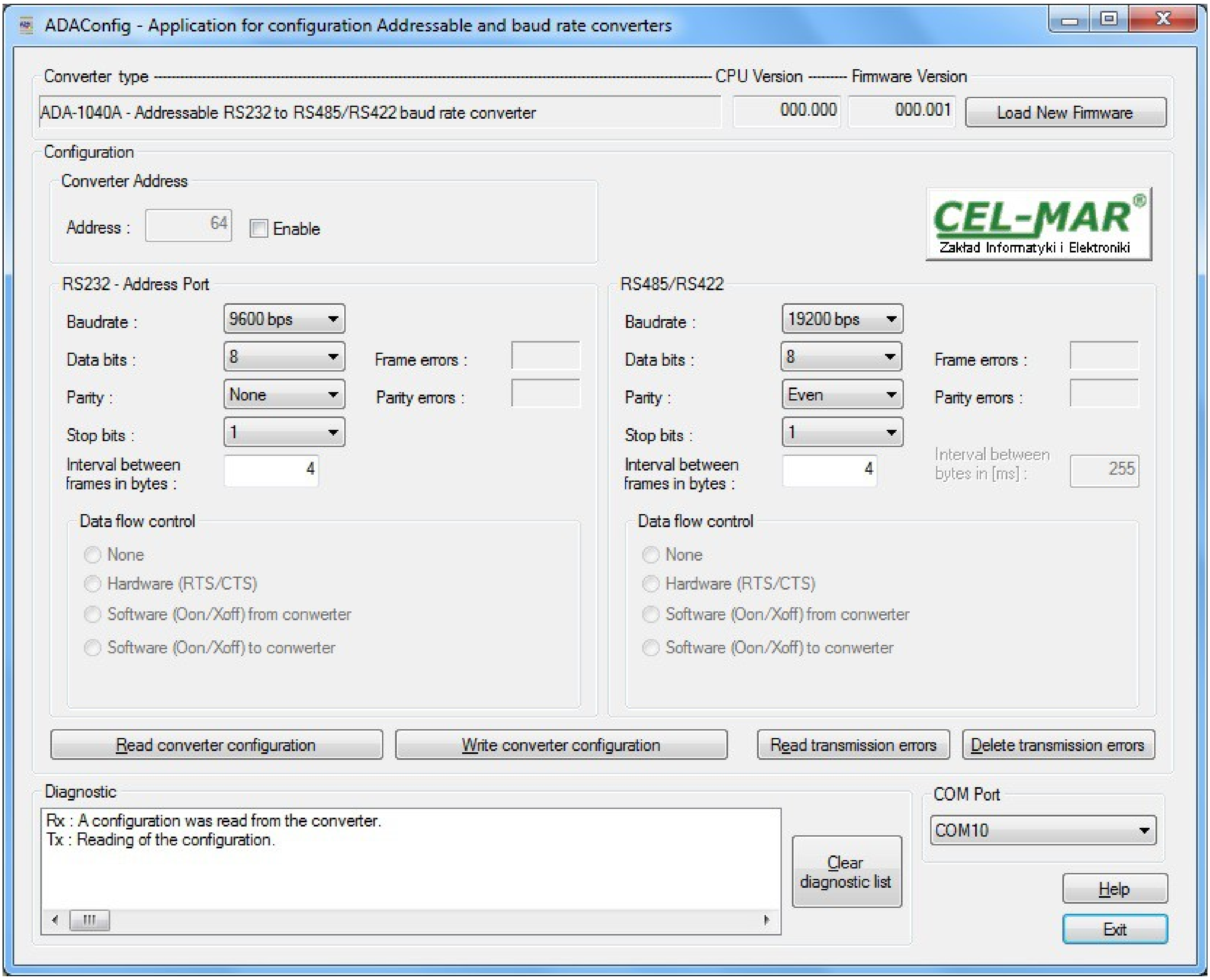


Fig. 8. View of *ADAConfig software interface*

5.3. FIRMWARE UPDATE

Set SW1 microswitch to configuration mode as in table below.

SW1-1	***SW1-2***
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz. Press a button ***[Load New Firmware]*** to change the software delivered by manufacturer. The Select File window will open (Fig.9) and select the *.bin file then click ***[Open]*** - software will be load to *ADAConfig* buffer storage and will be checked. If the *ADAConfig* not detect errors in loaded file, change converter software. Process of updating is visualized by *ADAConfig* in use Progress Window and after proper changing confirmed by correct message.

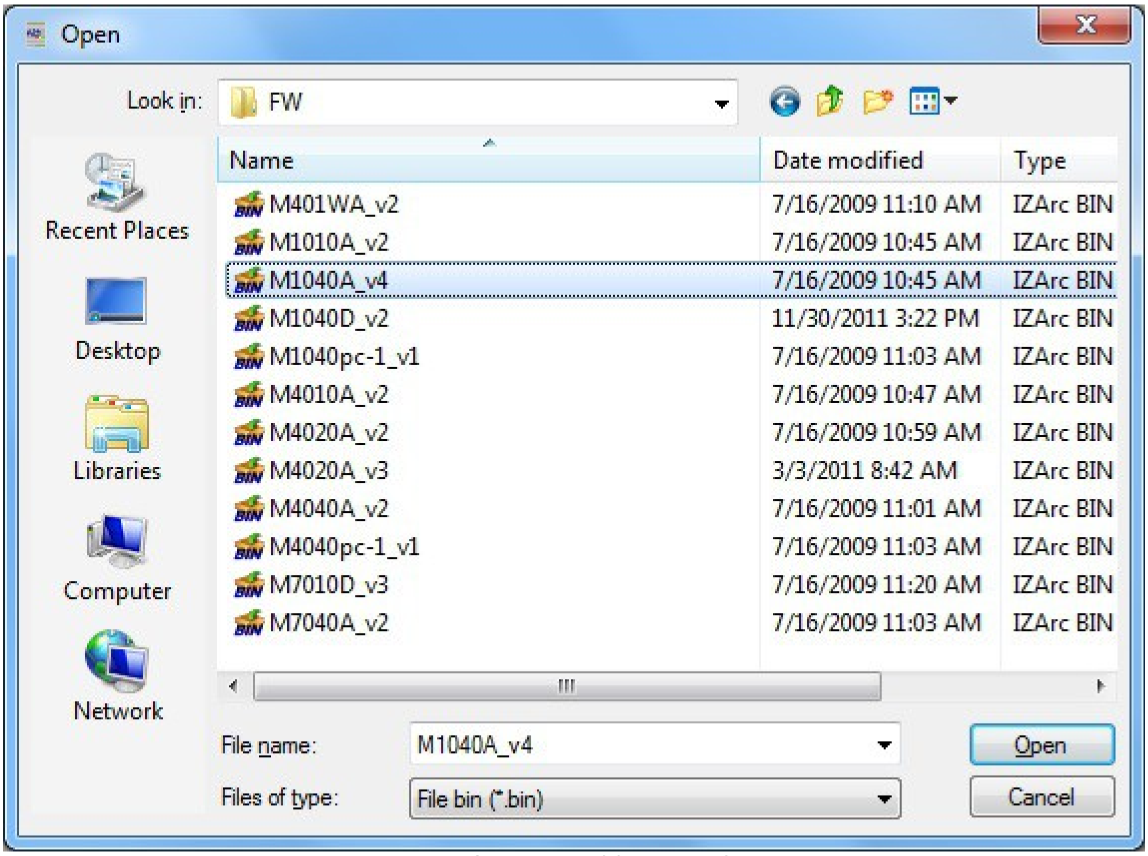


Fig. 9. Selection of firmware file

During loading software the yellow LED located beside SW1 micro-switch will blink, showing data flow to the converter. If the software was loaded correctly yellow LED will be blink with frequency 1 Hz.
After that set microswitch SW1 to run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF

5.4. EMERGENCY FIRMWARE UPDATE

In case of the unsuccessful update of the converter software, try again according to description in point 5.3. If the update is still incorrect use emergency firmware update. Set SW1 microswitch mode as in the table below.

SW1-1	***SW1-2***
ON	ON

After micro-switch setting, should be restarted the ADA-1040A, by turning OFF and then ON the power supply. The yellow LED will light continuously and the converter will be in Emergency Firmware Update mode. Now follow the description in point 5.3.

ATTENTION!
AFTER SUCCESSFUL UPDATING SET SW1MICRO-SWITCH AS IN TABLE BELOW

SW1-1	***SW1-2***
OFF	OFF

6. DATA TRANSMISSION DIAGNOSTICS

To readout diagnostics, the SW1 microswitch should be set to the configuration mode.

SW1-1	*SW1-2*
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz.
Correctness of transmission proceed on RS232 and RS485 interfaces can be checked by readout the errors list by *ADAConfig* Software from the converter memory. Frames error counter will be increased, in case of: improper speed set compared to real speed of data transmission. Parity error counter will be count the errors which can arise in case of misrepresent bytes in transmitted sign. This counter will not work in case of disable control parity
To check those counters press the button ***[Read transmission errors],*** and to delete (zeroing of counters in the memory of the converter) press ***[Delete transmission errors].*** In case of parity errors or frame errors, should be checked the ADA-1040A converter's configuration and correctness connection of RS485 bus and RS232 device to converter ports.
After finishing the diagnostics, the SW1 microswitch should be set to the run mode as shown in the table below.

SW1-1	*SW1-2*
OFF	OFF

The yellow LED (located near the SW1), will turn off.

7. OPERATION

ADA-1040A converter can operate in to two modes: not addressable and addressable.

7.1. OPERATION IN NON ADDRESSABLE MODE

In this mode ADA-1040A operates as baud rate converter and data format converter and lets to set different baud rates and data format on RS232 & RS485/422 interfaces.
It lets connect to RS485 bus old devices with RS232 interface, operate with non-configure baud rate and data format, on which operate devices with different baud rate or data format.

7.2. OPERATION IN ADDRESSABLE MODE

In this mode ADA-1040A operates as baud rate converter and data format converter and lets to connect no addressable devices with RS232 interface, transmitting data at different rates and formats of data frame to the RS485 bus, in the process of enabling the cooperation with addressable devices.
Example connection of ADA-1040A is shown on fig. 10.
On RS485 bus the frame of protocol for no addressable RS232 devices should be created in the following way:

ADDRESS ADA-1040A	*FRAME OF NO ADDRESSABLE DEVICES*

Where:

ADDRESS ADA-1040A - one byte of address from 1-255 scope,

FRAME OF NO ADDRESSABLE DEVICES - free sequence of bytes containing the appropriate frame of RS232 device, Not longer than 950 bytes.

ADA-1040A converter with set up addressing is listening constantly of frame on RS485 bus. If received frame contains byte of address equal to address of converter, then another bytes of frame are received, right up to silence on RS-485 bus equal to 'space between frames in signs'. If the frame is received correctly, the address byte is deleted and transmitted over as typical to RS232 interface. In case of errors in received frame, it isn't transmitted to RS232 interface. In this case should be send the previous frame one more.

The frame received from device connected to RS232 port is being tested of transmission errors and in case of their missing the converter adds address to the beginning of frame and send it to RS485 bus. Frame containing errors isn't being transmitted to RS485 bus. In case of transmitting of frames containing more than 950 bytes converter receive only 950 bytes and next are ignored. ADA-1040A has equipped with separate buffers for RS485/422 and RS232, therefore converter can operate in full duplex mode on RS-422 and RS-485 4-wire bus.

On a picture below are shown the possibilities of using the addressable ADA-1040A baud rate converter.

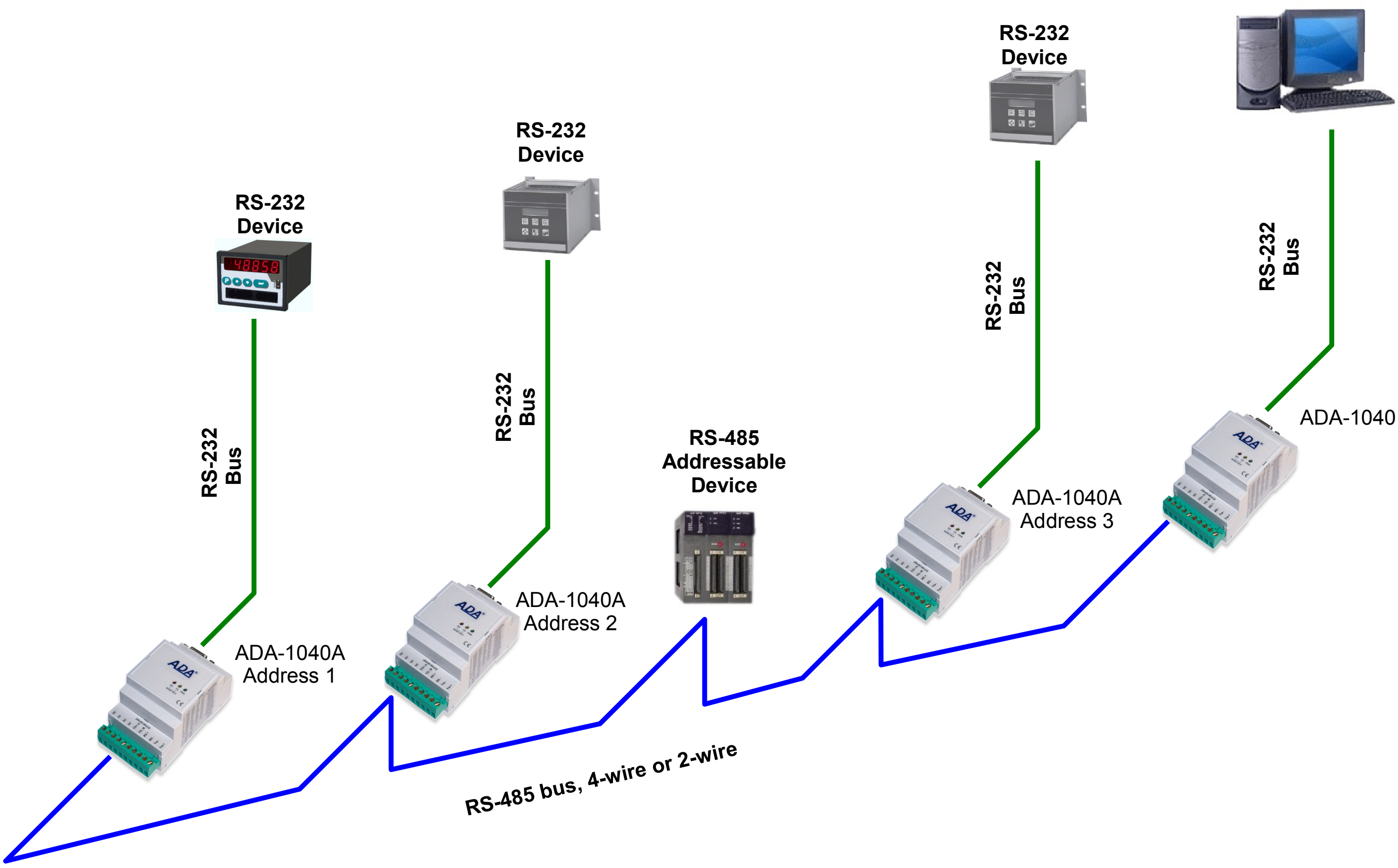


Fig. 10. Connection of no addressable devices with RS232 interface to RS485 bus

8. RS232 INTERFACE – PIN DESCRIPTION OF DSUB-9F-DCE SOCKET

Pin	Signal	Description	ADA-1040A
1	(DCD)	Level of receiver signal	Connected with DSR
2	(TxD)	Data transmission from ADA-1040A	Transmitter
3	(RxD)	Data receiving via ADA-1040A	Receiver
4	(DSR)	Readiness of data transmitting/receiving	Connected with DTR
5	(SG)	Signal ground	GND
6	(DTR)	Readiness of ADA-1040A to data receiving/ transmission	Connected with DSR
7	(CTS)	Device confirm of receiving RTS signal from ADA-1040A	Connected with RTS
8	(RTS)	ADA-1040A reports to device readiness to receiving data	Connected with CTS
9	(RI)	Call rate	Not connected

9. VERSIONS

ADA-1040A - ☐ - ☐

Galvanic isolation:

1kV= 2-way	**2**
1kV= 3-way	**23**
3kV= 2-way	**3**
3kV= 3-way	**33**

Terminal & Terminal Cover:

Cover without inlets, screw terminal block	**1**
Cover without inlets, screw terminal block	**2**
Cover without inlets, plug-in screw terminal block	**3**

Order example:
Product Symbol: **ADA-1040A-23-3**
23 - galvanic isolation: 1kV= 3-way,
3 - cover without inlets, plug-in screw terminal block

10. SPECIFICATION

Transition Parameters		
Interface	**RS-232**	**RS-485/RS-422**
Connector	DSUB-9 Female	Screw terminal block - max. Ø 2,5mm^2
Max. Line length	15 m	1200 m
Max. number of connected device	1	32 / 2
Transmission line	DB9F/DB9M multicore cable 9x0,34 shielded or 9-pair twisted cable, UTP 9x2x0,5 (24AWG) shield inside large interferences STP 9x2x0,5 (24AWG).	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5 (24AWG)
Standards	EIA-232, CCITT V.24	EIA-485, CCITT V.11
Max. baud rate	230,4 kbps	
Transmission type	Asynchronous full duplex, half duplex.	
Optical Signalization	• PWD – green LED power supply, • RX - red LED data receiving on RS485/RS422, • TX - yellow LED data transmission via RS485/RS422.	
Nominal Operating Conditions		
Power requirements	10 - 24 – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m	
Power	<2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kVDC or 3kVDC - between power circuit and RS-232 signal line	
Optoisolation	5kV - between signals lines RS-232 and RS-485/422	
Operating temperature	0 ÷ +23 ÷ 50°C	
Humidity	5 ÷ 95% - non-condensing	
Location during work	Free	
Mounting	Rail mounting according to DIN35 standard / TS35.	
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.	
Safety requiring	According to the PN-EN60950 norm.	
Environment	Commercial and light industrial.	
Casing		
Dimensions	53 x 90 x 58mm,	
Material	Noryl UL. 94 V-O	
Degree of casing protection	IP40	
Degree of terminal protection	IP20	
Weight	0,10 kg	
According to standards	DIN EN50022, DIN EN43880	
Storing and Transportation		
Storage temperature	-40 ÷ +70°C	
Humidity	5 ÷ 95% - non-condensing	

Dear Customer,

Thank you for purchasing **CEL-MAR Company** products.

We hope that this user manual helped connect and start up the **ADA-1040A converter**. We also wish to inform that we are a manufacturer of the widest selections of data communications products in the world such as: data transmission converters with interface RS232, RS485, RS422, USB, Current Loop, Fibre-Optic Converters and Ethernet or Wi-Fi.
Please contact us to tell how you like our products and how we can satisfy you present and future expectation.

CEL-MAR sp.j.
Zakład Informatyki i Elektroniki
str. Ściegiennego 219C
25-116 Kielce, POLAND

Tel...: +48 41 362-12-46
Tel/fax..: +48 41 361-07-70
Web...: http://www.cel-mar.pl/en
Office...: office@cel-mar.pl
Sales department...........................: handlowy@cel-mar.pl
Technical information ....: support@cel-mar.pl